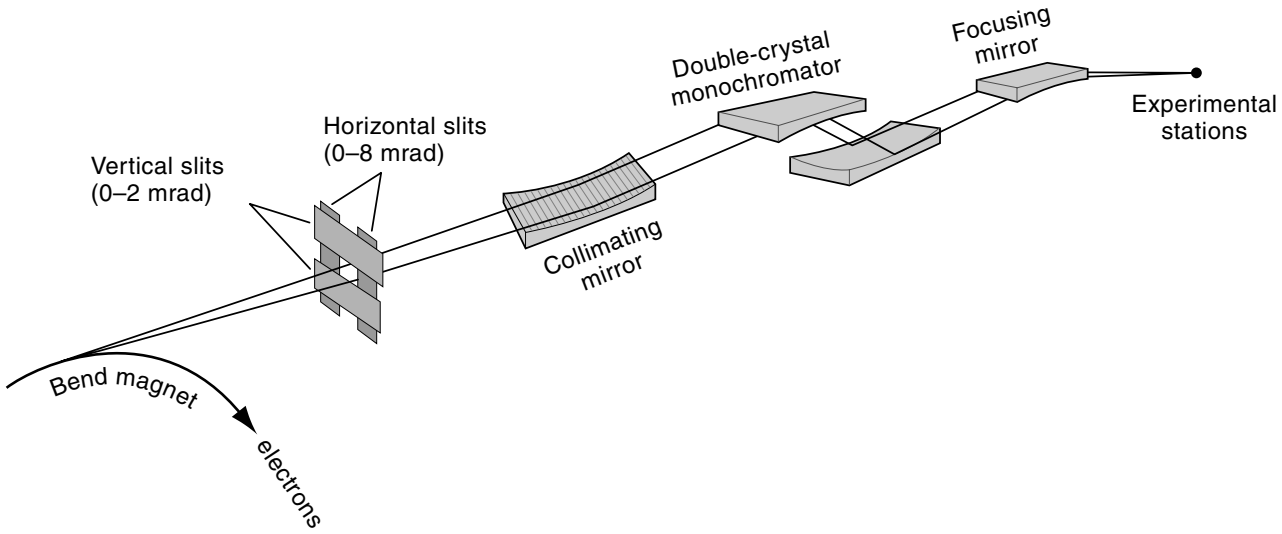
# High-Resolution Spectroscopy for AMO and Materials Science • Beamline 9.3.1

Berkeley Lab • University of California

## Beamline Specifications

| Photon Energy Range (keV) | Photon Flux (photons/s) | Spectral Resolution (E/ΔE) | Spot Size (mm) | Availability |
|---|---|---|---|---|
| 2.2–6.0 [with Si(111) crystals] | $>10^{11}$ | 3000–8000 | <0.5 | NOW |




*Schematic layout of Beamline 9.3.1.*

Beamline 9.3.1 is a bend-magnet beamline that provides high-resolution x-ray beams for electron, ion, and x-ray spectroscopy measurements in atomic, molecular, and materials science. The beamline is built around a double-crystal monochromator to provide higher-energy x-rays than are available at most other beamlines at the ALS.

The optical design includes two identical, but oppositely deflecting, toroidal mirrors positioned symmetrically before and after the monochromator. This novel approach simultaneously yields two benefits: high resolution, by providing parallel x-rays for diffraction by the double-crystal monochromator, and a small beam spot, by means of 1:1 focusing of the storage-ring source with a minimum of aberrations. By accepting up to 8 horizontal mrad from an ALS bend magnet, the beamline delivers $>10^{11}$ photons/s over most of its photon energy range.

Several interchangeable PRT-owned experimental stations for gas-phase measurements are available for use at the beamline. Two of these instruments use ALS two-bunch operation to do either time-of-flight (TOF) ion mass spectroscopy or photoelectron spectroscopy with five electron-TOF analyzers operating simultaneously. Both devices can use specialized electronics to perform ion-ion or electron-electron coincidence measurements. A third instrument will measure x-ray emission spectroscopy in gases, with both angular and polarization sensitivity. Finally, a small absorption cell is located in the beamline that can be used to perform absorption spectroscopy of gases or thin foils. ■

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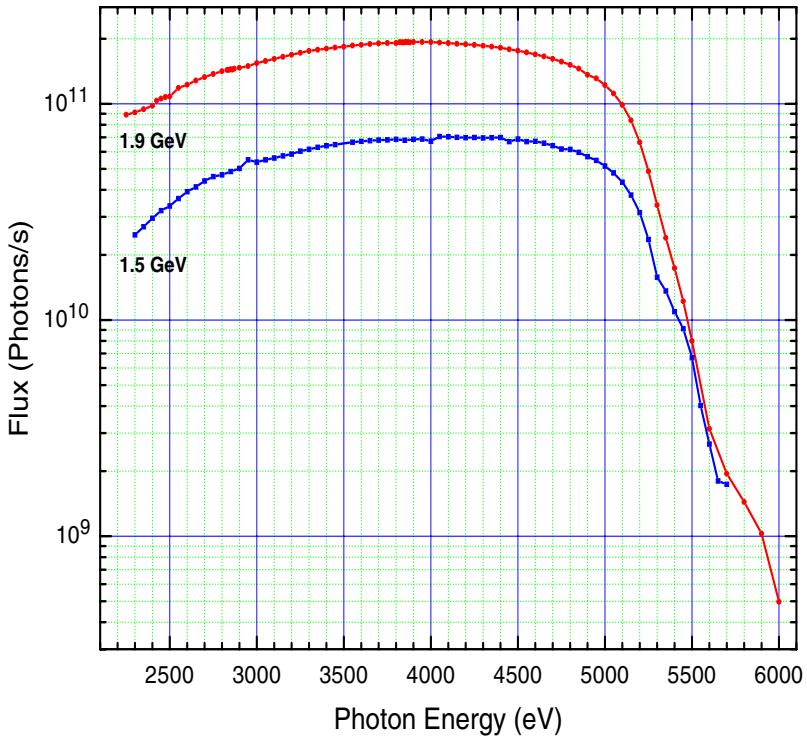
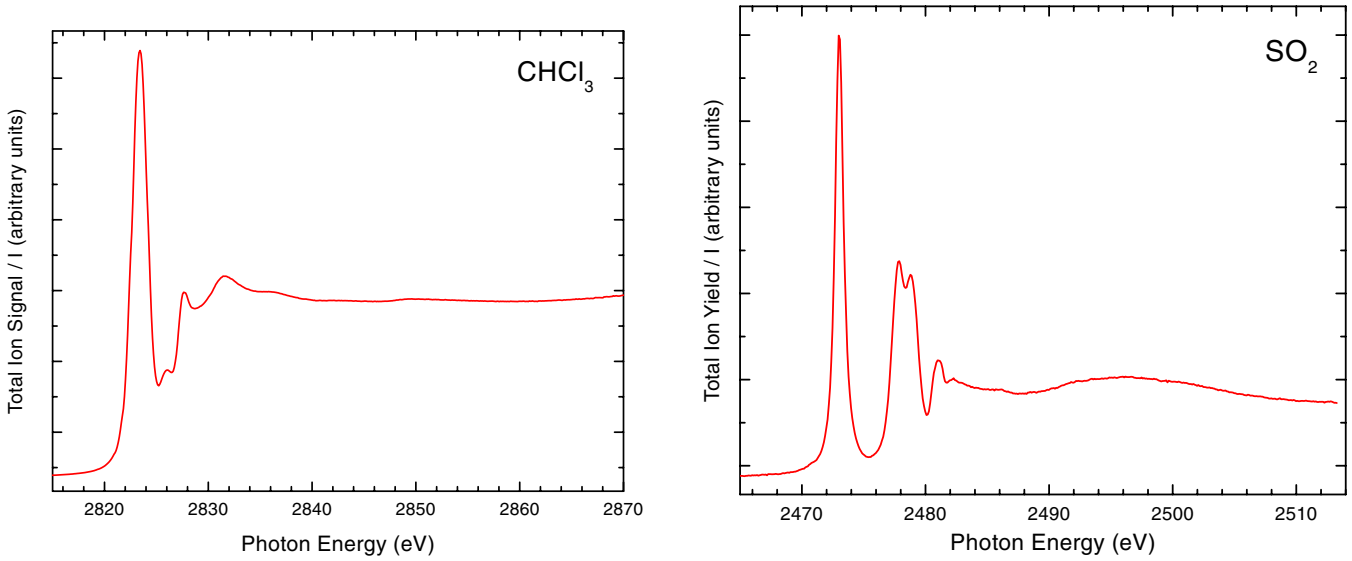



***Approximate photon flux from Beamline 9.3.1.*** *The measurements were taken with Si(111) crystals in the monochromator and at a storage ring current of 200 mA while accepting nearly 3 horizontal mrad from the bend magnet. The decrease observed at high energy is due to the cut-off energy of the beamline mirrors at their nominal angles of incidence. These angles can be varied in situ to shift the cut-off to higher or lower energies.*




***Absorption spectra.*** *Total yield spectrum of $CHCl_3$ in the vicinity of the chlorine K edge (left). Total ion yield spectrum of $SO_2$ in the vicinity of the sulfur K edge (right). All measurements were performed at Beamline 9.3.1 during January/April 2000. Data courtesy of Wayne Stolte (LBNL).*

**This beamline is available to independent investigators by submitting a proposal.**

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